

## **The 64-Bit Dual-Core Intel® Xeon® Platform: Support for Next-Generation Data Centers**



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## The 64-Bit Dual-Core Intel® Xeon® Platform: Support for Next-Generation Data Centers

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### **Overview: Business-Critical Performance and Reliability**

Servers based on next-generation 64-bit Dual-Core Intel® Xeon® 5000 series processors help reduce IT operating costs, enhance security and availability, and improve IT agility while delivering the highest dual-processor server performance—all contributing to a low total cost of ownership and higher return on IT investments.

The performance and energy efficiency of platforms based on the new Dual-Core Intel Xeon processors make them the best-in-class choice for virtualization initiatives and business-critical applications, enabling IT to become more efficient and responsive. New reliability features that lead the competition proactively protect data to help ensure critical systems are available around the clock.



### **Improved ROI Through Lower Cost, Energy-Efficient Performance**

With up to twice the performance of previous single-core Intel Xeon processors, Dual-Core Intel Xeon 5000 series processors enable servers to handle more simultaneous work. By increasing per-core performance as well as overall processor performance, Intel Xeon processor 5000 series-based platforms can provide a solid foundation for increasing data center compute capacity.

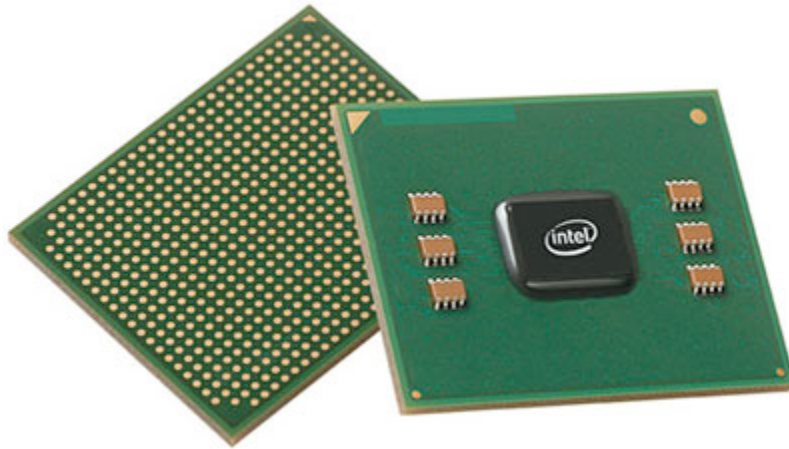
HP is already taking advantage of Dual-Core Intel Xeon 5000 series processors. “The upcoming portfolio of industry-leading HP ProLiant\* 2P servers combines the latest dual-core Intel technology with HP’s balanced system architecture to offer customers cutting-edge technologies that deliver leading performance and performance per watt,” says Paul Miller, vice president of Industry-Standard Servers at HP. “By advancing the key subsystems of the new 2P ProLiant servers, which are optimized for virtualization and leverage the leading infrastructure management software, customers are able to take full advantage of the performance to grow and align their IT infrastructure with changing business needs.”

“As an ISP, we spend significant amounts of money on energy supply and data center space. The new Dual-Core Intel® Xeon® processor-based servers deliver not only a tremendous performance boost but significantly increase power efficiency, too.”

—Uwe Braun, Managing Director of Host Europe



Servers based on Intel Xeon 5000 series processors are easier and less expensive to deploy, provision, manage, and protect. Optimized for rack and blade form factors, the new 95-watt processors boost power efficiency by up to 70 percent, making them ideal for increasing server density in crowded data centers.<sup>1</sup>



Balanced system designs are essential to reaping all the benefits of processor advances. In Intel Xeon 5000 series processors, Intel® I/O Acceleration Technology moves network data efficiently to help eliminate I/O bottlenecks and reduce system overhead (see the “Improve Network Throughput with Intel I/O Acceleration Technology” sidebar for more information).

Another key aspect of the system design is the fully buffered DIMM (FBDIMM) architecture, which is widely recognized as the next leap in memory technology and is gaining broad support from memory manufacturers and original equipment manufacturers (OEMs). FBDIMMs remove memory access bottlenecks through higher data rates and lower latency, boosting server responsiveness for data-intensive applications.

As a result of their balanced design, systems using Intel Xeon 5000 series processors with FBDIMMs and low-power DDR2-667 memory have four times the memory capacity (up to 64 GB) and three times the peak bandwidth of systems based on previous-generation Intel Xeon chipsets (up to 21 GBps with 1333 MHz system bus<sup>2</sup>).

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Intel Xeon 5000 series processors with FBDIMM technology also deliver the added boost of improved platform reliability through better data protection and data availability. And because FBDIMM technology is transparent to operating systems and software applications, the transition costs are low and the overall return on reliability, availability, and serviceability (RAS) investment can be significant.

The improved energy efficiency of new Intel Xeon 5000 series processors will be particularly appreciated by businesses that rely on large data centers. “As an ISP, we spend significant amounts of money on energy supply and data center space. The new Dual-Core Intel Xeon processor-based servers deliver not only a tremendous performance boost but significantly increase power efficiency, too,” says Uwe Braun, managing director of Host Europe. “This means huge savings in our energy bills as well as boosting the processing power we can get per square meter in our data centers. We are looking forward to deploying the platform more widely throughout our data centers.”



**Tools, Training, and Technology**

To supplement the capabilities of the new Intel® Xeon® processors, Intel offers software tools, training, and support to help developers optimize their software for multi-core processors and 64-bit computing.

Now used by over 200,000 commercial, open source, and corporate developers, Intel® Software Development Products help developers create software that delivers leading 64-bit dual-core performance and power efficiency across all compatible server platforms while taking advantage of the multi-core architecture of Intel Xeon processor-based systems.

Intel® compilers help accelerate development software performance with advanced support for dual-core threading through OpenMP\* and auto-parallelism capabilities. The Intel® Math Kernel Library (Intel® MKL) is a set of highly optimized mathematical routines designed for applications that require maximum performance on Intel processors. The Intel Integrated Performance Primitives (Intel® IPP) is a software library of highly optimized functions for multimedia, audio, video, speech, computer vision, image, and signal processing.

Visit the Intel Web site to learn more about Intel® Software Development Products.

In addition, the Intel® Software Network and the Intel® Software College offer training, information, and resources that can help software developers optimize their software more effectively and at less cost.

**Built-In Support for Virtualization Software**

Server virtualization is one of the best ways to reduce costs while also improving agility and availability. The benefits of a virtualized IT environment can be substantial, including infrastructure simplification, faster provisioning, improved flexibility to match IT resources to user needs, reduced-cost development environments, and affordable alternatives for business continuity. Because of these advantages, many organizations already have virtualization initiatives underway.

Intel Xeon processor 5000 series-based servers include Intel® Virtualization Technology, which complements today's leading virtualization software, making virtualization more dependable, interoperable, and supportable. In addition, virtualized servers based on the new Intel Xeon processor have the ability to run both 64- and 32-bit applications, giving IT ultimate flexibility to adapt to changing business needs.

“With built-in hardware-assisted virtualization featured in [Dual-Core Intel Xeon processor-based platforms] and the release of Microsoft Windows\* hypervisor technology in the Windows Server\* ‘Longhorn’ wave, customers will benefit from optimized hardware utilization and data center agility,” explains Mauro Meanti, general manager of the Server & Tools Business Group at Microsoft EMEA. “All of this means breakthrough performance, increased business agility, and better energy efficiency for businesses.”

Specifically, Intel Xeon processor 5000 series-based platforms include the following features:

- **A new, privileged space for the virtual machine monitor (VMM)** reduces the need for VMM intervention and allows virtualized operating systems to run directly on the server. Intel Virtualization Technology eliminates many potential conflicts, simplifies VMM requirements, and improves compatibility with unmodified operating systems.
- **Hardware-supported handoffs between the VMM and guest operating systems** reduce the need for complex, compute-intensive software transitions.
- **Hardware-based memory protection** retains processor state information for the VMM and each guest operating system in dedicated address spaces, accelerating transitions and helping to ensure process integrity.



With these features, platforms based on Intel Xeon 5000 series processors provide advantages to both software vendors and IT organizations, including the following:

- **Reduced cost and risk for IT organizations**—Greater independence between the VMM and the operating system helps eliminate the need to synchronize upgrades and patches. Thus, maintenance costs are reduced, and IT organizations can support a much wider range of operating system versions on a common platform.
- **Simpler VMM development**—Independence between the VMM and guest operating systems also enables applications to take advantage of the latest platform capabilities with less need for VMM development and tuning. This can reduce deployment times for new features and applications.
- **Improved reliability and availability**—Reducing the complexity of VMMs and enabling them to be independent of guest operating systems can reduce the potential for conflicts that might otherwise slow or halt operations.
- **Enhanced security**—Managing VMM transitions in hardware rather than software helps to strengthen the isolation of virtual machines. A smaller and less complex VMM also provides fewer opportunities for software-based attacks.

Intel Virtualization Technology supports the most common virtualization software, including VMware ESX Server\*, Microsoft Virtual Server\*, and XenSource XenEnterprise\*. To learn more about Intel Virtualization Technology, go to [www.intel.com/info/virtualization](http://www.intel.com/info/virtualization).

Intel I/O Acceleration Technology and FBDIMM also benefit virtualized servers by providing more headroom—contributing to up to 35 percent better performance than previous dual-core Intel Xeon processor-based servers.<sup>3</sup> As a result, platforms based on the new Intel Xeon processors can handle more applications on a virtualized server to further lower costs and simplify the data center while helping lower the risk of having insufficient capacity to enable a more secure return on the server investment.

## ***Reliability Features Help Ensure Business Continuity***

Intel Xeon processor 5000 series-based servers help meet today's real-time, always-on business continuity requirements with built-in reliability-enhancing features such as memory error detection and correction, data protection, and serviceability capabilities. These best-in-class hardware-based features increase virtual server isolation and help reduce the propagation of attacks, especially valuable in virtualized environments since platform failure could impact dozens of applications.

Eliminating frequent exchanges of data between servers and storage can improve both performance and availability. With up to 64 GB of memory addressability, Intel Xeon processor 5000 series-based servers can process large data sets in memory, keeping data close to the processing cores to enhance reliability and availability.

Two other memory-based features help improve availability. Memory mirroring protects applications and data against uncorrectable errors and DRAM failures. And memory sparing allows IT to reserve spare memory capacity that can be put into service if online memory fails.

Intel Xeon processor 5000 series-based servers are also designed to help reduce downtime due to maintenance. For example, Intel® x8 Single Device Data Correction (SDDC) allows IT staff to automatically resolve memory errors without disrupting the applications, by enabling the memory system to detect and correct data and to recover from faults within DDR memory devices in the memory system.

The Error Correcting Code (ECC) function detects single-bit and double-bit errors and automatically corrects single-bit errors on internal data paths, making it easier for IT to diagnose problems and determine root causes. In addition, cyclical redundancy checking and error correction on address, command, and data paths help enhance system availability. And the hot-plug I/O feature enables IT staff to add physical or virtual devices without interrupting operations.



Referring to his company's Intel processor-based server solutions, Todd Stewart, group director of computing operations at Siebel Systems, explains, "It makes great sense for us to run inexpensive, standard servers in a high-availability scenario.... Their failure rate is basically zero."<sup>4</sup>

However, platform reliability means more than just high uptime. It also means broad compatibility with today's complex hardware and software environments so IT can deploy solutions quickly and with confidence. Intel has established one of the world's most extensive environments for testing and validating server components and platforms.<sup>5</sup>

## **Improve Network Throughput with Intel® I/O Acceleration Technology**

Intel® I/O Acceleration Technology (Intel® I/OAT) moves network traffic efficiently through Intel® Xeon® processor 5000 series-based platforms to free resources for more critical tasks and improve application responsiveness across virtualized environments. Intel I/OAT leverages architectural improvements within the processor, chipset, network controller, and firmware to minimize performance-limiting bottlenecks.

Intel I/OAT also optimizes network data processing across all critical platform components to increase I/O throughput by up to 30 percent over platforms without the technology. It reduces the I/O-related load on the processor by up to 50 percent, so both I/O and processing performance are improved with little or no increase in power consumption.

Cost-effectively scaling to up to eight Gigabit Ethernet ports at 10 Gigabit performance, Intel I/OAT maintains power and thermal requirements similar to those of standard gigabit network adapters.

Tight integration into popular OSs such as Microsoft Windows Server\* 2003 and Linux\* helps Intel I/OAT increase reliability by avoiding support risks associated with relying on third-party hardware vendors for network stack updates. Intel I/OAT also preserves critical network configurations such as teaming and failover by maintaining control of the network stack processing within the processor. This results in reduced support risks for IT departments.

To learn more about Intel I/OAT, visit the Intel Web site.

## **Summary**

From one generation to the next, Intel Xeon processor-based servers have helped IT solve some of the toughest business and IT challenges, gaining a track record for powering the most widely deployed servers in the world. Industry-leading Intel technologies help IT organizations build and maintain efficient, dependable, and responsive infrastructures.

New Dual-Core Intel Xeon processor 5000 series-based platforms today set a high standard for improved power efficiency, support for virtualization, and availability for both 64-bit and 32-bit applications. The new Intel Xeon processor is ideal for a broad range of solutions—from front-end and mid-tier software applications to departmental and mid-size databases, enterprise e-mail solutions, and enterprise Web servers.

The Bensley platform, which provides longevity by spanning multiple processor generations, is shipping now with the Dual-Core Intel Xeon 5000 processor series, and will support the next-generation processor, the Dual-Core Intel® Xeon 5100® series processor in June, 2006. The Dual-Core Intel Xeon 5000 processor series provides the industry's lowest price point today for dual-core processor (DP) servers with the best performance in its class. The new Dual-Core Intel Xeon processor 5100 series is targeted to provide industry-leading energy-efficient performance when available in early Q3 to enable even greater cost savings and investment returns for businesses and organizations of all types.<sup>6</sup>





<sup>1</sup> Comparisons are based on Intel internal measurements of previous 64-bit Intel® Xeon® single-core processor-based platforms, May 3, 2006.

<sup>2</sup> Performance comparison is to Intel® Xeon® processor-based platforms with Intel® E7520 chipset and DDR2-400 memory.

<sup>3</sup> Comparisons are based on Intel internal measurements of previous 64-bit Intel® Xeon® processor-based platforms, May 3, 2006.

<sup>4</sup> Siebel Systems is the world's leading supplier of customer relationship management solutions. For more information about the company and their Intel® architecture-based deployment, see the Intel case study.

<sup>5</sup> For an average platform, Intel devotes approximately 600 quarters of engineering hours and roughly a half million hours of validation runtime, all within a 12-15 month product lifecycle (from prototype to production).

<sup>6</sup> To learn more about the new Dual-Core Intel® Xeon® processors, visit the Intel Web site.

## **More Info**

To learn how new Dual-Core Intel® Xeon® processor-based servers deliver business-critical performance, reliability and value, visit the Intel Web site.

—End of Technology@Intel Magazine Article—

